Atty. Docket No. 404982

IN THE CLAIMS

1. (Currently Amended) A method of forming a workpiece with a shaped workpiece surface having at least a portion that is axially asymmetric, the method comprising the steps of:

providing a ~~slow tool servo assembly having a~~ tool assembly and a spindle assembly,

the spindle assembly (a) securing said workpiece, ~~and~~ (b) being rotatable about ~~an~~a spindle axis ~~of rotation~~, and (c) having a rotary encoder to provide angular position feedback of the workpiece relative to the tool assembly,

the tool assembly having

a first x-axis linear drive for moving said tool assembly in an x-axis orthogonal to the spindle axis ~~of rotation~~,

a second z-axis linear drive for moving said tool assembly in ~~an~~ a z-axis parallel to the spindle axis ~~of rotation~~,

a tool, and

a table, rotatable about a table axis, for manipulating an angle of the tool; ~~and~~

~~an encoder to provide angular position feedback of the tool relative to the workpiece;~~

rotating the spindle assembly ~~between 30 revolutions per minute and 200 revolutions per minute~~;

~~positioning the tool in contact with the workpiece;~~ and

oscillating the tool assembly ~~transversely and longitudinally~~in at least one of the x-axis and the z-axis with respect to the workpiece surface such that the tool ~~to~~ selectively removes portions of the workpiece to form the axially asymmetric portion of the workpiece surface by controlling the location of a contact point of the tool and workpiece along the z-axis ~~parallel to the spindle axis of the rotation~~, the contact point location being a function of ~~the~~an x-axis contact point location ~~of the contact point along an x-axis~~ and a function of ~~the~~an angle of rotation of the spindle about the spindle axis.

2. (Currently Amended) The method of claim 1, wherein the slow tool servo assembly further comprises a controller having a processor and wherein the method further comprises the steps of:

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inputting a formula to the processor corresponding to a desired shape for [[a]]the workpiece surface;

simultaneously ~~measuring~~determining a ~~the~~ relative angle of rotation of the spindle about the spindle axis, and ~~the~~a relative transverse linear location of at least one of the contact point and ~~working~~the tool; and

processing the ~~inputted~~ formula, using the ~~measured~~relative angle of rotation and the x-axis contact point location, to determine ~~the necessary~~a z-axis location ~~of~~for at least one of the workpiece surface and tool.

3. (Currently Amended) The method of claim 1, further comprising the steps of:

predetermining a slope and orientation of the workpiece surface at a specific location; and

generating a command signal to rotate [[a]]the table ~~upon which the tool assembly is mounted, the table rotating about a b-axis orthogonal to the x-axis and z-axis~~ to maintain perpendicularity of the tool relative to the workpiece surface.

4. (Original) The method of claim 1, wherein the tool is a grinding wheel.

5. (Original) The method of claim 1, wherein the tool is a single point diamond cutting tool.

6. (Currently Amended) An apparatus for forming an axially asymmetric portion of a workpiece surface, the apparatus comprising:

a spindle assembly having a ~~rotable~~ spindle for holding the workpiece, the spindle being selectively rotatable about ~~an~~a spindle axis ~~of rotation~~, the spindle assembly having a rotary encoder to provide angular position feedback of the workpiece; and

a tool assembly having

a tool for contacting the workpiece,

a first x-axis linear drive for moving said tool assembly in an x-axis ~~parallel~~orthogonal to the spindle axis ~~of rotation~~,

a second z-axis linear drive for moving said tool assembly in ~~an~~a z-axis ~~orthogonal~~parallel to the spindle axis ~~of the first linear drive~~, and

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a table that is movable along the x-axis and the z-axis through the first x-axis linear drive and the second z-axis linear drive, the table being rotatable about a table axis, the tool being mounted to the table ~~and an angular rotation sensor to provide angular position feedback of the tool relative to the workpiece~~.

7. (Currently Amended) The apparatus of claim 6, wherein the ~~angular position sensor~~encoder is coupled to the spindle to detect ~~the~~an angle of rotation of the spindle.

8-10. (Canceled)

11. (Currently Amended) The apparatus of claim ~~10~~6 wherein the table is ~~rotatable about an axis of rotation orthogonal to said x-axis and z-axis, the rotatable table being~~ operably configured to maintain a substantially perpendicular relationship between the tool and said workpiece surface.

12. (Currently Amended) The apparatus of claim ~~11~~6 wherein the tool ~~assembly~~ is a diamond turning machine.

13. (Currently Amended) The apparatus of claim ~~11~~6 wherein the tool ~~assembly~~ is a grinding machine.

14. (Currently Amended) The apparatus of claim 6, ~~wherein the apparatus for forming an axially asymmetric portion of a workpiece surface~~ further ~~comprises~~comprising a controller for controlling at least one of said first x-axis linear drive, second z-axis linear drive and ~~the~~a relative angular rotation of the ~~rotary~~ table.

15. (Currently Amended) An apparatus for forming an axially asymmetric portion of a workpiece surface, the apparatus comprising:

a spindle assembly having a ~~rotable~~ spindle for holding the workpiece, the spindle being selectively rotatable about ~~an~~a spindle axis ~~of rotation~~, the spindle assembly having a rotary encoder to provide angular position feedback of the workpiece;

a tool assembly having

a tool for contacting the workpiece,

a first x-axis linear drive for moving said tool assembly in an x-axis ~~parallel~~orthogonal to the spindle axis ~~of rotation~~,

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a second z-axis linear drive for moving said tool assembly in ~~an~~a z-axis ~~orthogonal~~parallel to the spindle axis ~~of the first linear drive~~, and

a table that is movable along the x-axis and the z-axis through the first x-axis linear drive and the second z-axis linear drive, the table being rotatable about a table axis, the tool being mounted to the table ~~an angular rotation sensor to provide angular position feedback of the tool relative to the workpiece~~; and

a processor for receiving the angular position feedback and x-axis position of the tool, and for determining a z-axis position for the tool.

16. (Currently Amended) The apparatus of claim 15 wherein the ~~tool assembly further comprises a table and the tool is mounted to the table, the table being movable along the x-axis and z-axis through the first x-axis linear drive and the second z-axis linear drive, the table further being rotatable about an axis of rotation orthogonal to said x-axis and z-axis~~processor determines an angle about the table axis to maintain a substantially perpendicular relationship between the tool and said workpiece surface.

17. (Currently Amended) The apparatus of claim ~~16~~15 wherein the tool ~~assembly~~ is a diamond turning machine.

18. (Currently Amended) The apparatus of claim ~~16~~15 wherein the tool ~~assembly~~ is a grinding machine.

19. (Currently Amended) The apparatus of claim 16 wherein the ~~controller~~processor controls the ~~relative angular rotation of the rotary table~~angle to maintain [[a]]the substantially perpendicular relationship ~~between the tool and said workpiece surface~~.

20. (New) The method of claim 1, wherein the table axis comprises a b-axis that is orthogonal to the x-axis and the z-axis.

21. (New) The apparatus of claim 6, wherein the table axis comprises a b-axis that is orthogonal to the x-axis and the z-axis.

22. (New) The apparatus of claim 15, wherein the table axis comprises a b-axis that is orthogonal to the x-axis and the z-axis.

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